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AQUILA NON CAPIT MUSCAS.
Philip Drake.

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THE
DESCRIPTION and USE
OF
Edward
NAIRNE's
Patent Electrical Machine;

WITH THE ADDITION OF SOME

PHILOSOPHICAL EXPERIMENTS,

AND

MEDICAL OBSERVATIONS.

THE FOURTH EDITION.

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THE

DESCRIPTION AND USE

OF

NAIRNE's

Patent Electrical Machine.

THOUGH this machine and its apparatus are conſtructed with a particular view to the purpoſes of medicine, yet it will be found equally applicable to philoſophical uſes. All its parts are inſulated in the beſt poſſible manner; and, from the expence and ſtudy which the inventor has beſtowed in rendering it perfect, it is much ſuperior in its action to any machine of the ſize yet made. In the following deſcription the ſame letter of the alphabet is uſed to denote the ſame thing in all the engravings, and every attention has been paid to make the whole intelligible and clear.

CHAP. I.

A DESCRIPTION OF THE PARTS OF WHICH THE MACHINE IS COMPOSED.

PLATE I. contains a perſpective view of the machine, all its parts being properly put together. The letters of reference in the preſent chapter reſpect this plate, except where it is otherwiſe mentioned.

A A. The glaſs cylinder.

B B. Two glaſs pillars which ſupport the glaſs cylinder A A.

C. The handle by which the glaſs cylinder A A is turned.

R. and G. Two metallic conductors.

D D. Two glaſs pillars, one ſupporting the conductor R, and the other G.

E. The board into which the pillars B B, which ſupport the cylinder A A, are fixed.

F F. Two pieces of wood. In theſe pieces are fixed the pillars D D, which ſupport the conductors R and G.

H H. Two knobs of braſs ſoldered on the outſide of each of the conductors R and G.

I. The cuſhion which is attached, by a contrivance hereafter mentioned, to the ſide of the conductor R, between that and the cylinder A A. The end of it is ſeen at Plate III. Fig. 1, 2, and 6.

K. The ſilk, one end of which is glued to the under part of the cuſhion I. It is turned over upon the cylinder A A, ſo that part of the ſilk is between the cylinder A A and the cuſhion I.

L. A ſcrew of wood which paſſes through a ſlit in the upper part of the board E into the piece F, which, by ſcrewing, draws the piece F up againſt the bottom of the board E. The uſe of it is to keep the glaſs pillar which is fixed in F, which ſupports the conductor R, to which the cuſhion is attached,

tached, in its place, when the cuſhion is preſſed gently againſt the cylinder A A.

M. The points which are ſoldered to that ſide of the conductor G which is next the cylinder A A. They are only ſeen at Plate III. Fig. 2.

N N. The ends of the conductors R and G, which may be taken off from the other part, as repreſented Plate V. Fig. 1; 2.

S. An electrical coated glaſs jar faſtened in the inſide of the conductor G. In the inſide of this jar is fitted a piece of cork, and in the cork a ſmall glaſs tube coated, and likewiſe a braſs wire with a ball, which are ſeen Plate V. Fig. 1, 2.

The internal part of the conductor R is fitted up exactly in the ſame manner.

P P. are knobs of braſs ſcrewed faſt to the board E. A piece of tin-foil is paſted on the board, ſo as to make a metallic communication between them. This piece of tin-foil is repreſented by the two parallel lines in Plate I. Plate IV. Fig. 1. and Plate V. Fig. 1.

O. The electrical ſtool, with its four glaſs legs. On the top of the board of the ſtool is faſtened a piece of lead communicating with two holes, into either of which holes the end of one of the tubes with the pliable joints f f f Plate II. are to be put, the other end being connected with either of the conductors. See Plate IV. Fig. 1 and 3.

Q. A large ſheet of paper to place the glaſs legs of the ſtool on. It is uſed to prevent the duſt or lint flying up from the floor or carpet to the ſtool when electrified. See Plate IV. Fig. 1, 3.

CHAP. II.

A DESCRIPTION OF THE APPARATUS.

PLATE II. contains drawings of the apparatus not deſcribed in the preceding chapter. In this plate the parts are repreſented as detached from the machine; but the plates referred to, are thoſe in which their application is ſhewn.

a. An iron clamp, or vice, Plate IV. Fig. 1.

b. An iron chain, with a braſs ring at each end, Plate I. Plate III. Fig. 1. Plate IV. Fig. 1. and Plate V. Fig. 1, 2.

c. A piece of card-paper, with a round piece of leather glued to it, on which the amalgam is firſt ſpread, before it is applied to the glaſs cylinder A A.

d. A compound joint, which has not only a vertical, but alſo an horizontal motion, when applied to the conductor R or G,

Plate III. Fig. 1, 2, 5, 6. Plate IV. Fig. 1, 2.

e e e. Three metallic tubes, connected by means of two wooden joints: they are here repreſented as ſcrewed to d, Plate III. Fig. 1, 2, 3, 4.

f f f. Three metallic tubes, connected by means of four pieces of wood, and two pliable or flexible joints, Plate I. Plate III. Fig. 5 and 6. Plate IV. Fig. 1, 2, 3.

g. A piece of wood fixed to one of the tubes f, and which has a hole at right angles to the tube into which one end of the glaſs handle k is put, Plate I. Plate III. Fig. 5 and 6. and Plate IV. Fig. 1, 2, 3.

h. A metallic ball, ſcrewed to the end of one of the tubes f or e, Plate I. Plate III. Fig. 1, 2, 5, 6. Plate IV. Fig. 2 and 3.

i. Braſs or wooden conical points, Plate III. Fig. 3, 4.

k. Glaſs handle, Plate III. Fig. 5 and 6. Plate IV. Fig. 3. Plate V. Fig. 2.

l. Clamp or vice of wood, Plate IV. Fig. 2.

m. Metallic cord, covered with worſted, Plate IV. Fig. 2 and 3.

n. Electrometer, Plate V. Fig. 1 and 2.

o. Metal chain, with a ring at one end, and at the other a piece of braſs wire, Plate V. Fig. 1, 2.

p. Piece of wood, with the braſs wire of o fixed to it, and which has a hole at right angles to the wire, in which one end of the glaſs handle k is put, Plate V. Fig. 1 and 2.

q. Screw-driver for tightening the ſide joint of d.

r. Forked ſcrew-driver for tightening the vertical joint of d, and alſo the two joints of e.

s. Pointril, to be put into the ſmall hole at the end of one of the tubes e or f, to unſcrew them, in caſe they ſhould get too tight to be unſcrewed by hand from the joint d.

t. Luminous inſulated diſcharging rod, invented by Edward Nairne.

u. Communicator, which is to be applied over the edge of the jar S, Plate V. Fig 1. when the glaſs tube withinſide the ſaid jar is to be uſed for the gentler ſhocks or vibrations, as directed Chap. IV. § 29.

With each electrical machine, which has the complete medical apparatus, there are ſent two ſets of that part of the apparatus marked b, c, d, e e e, f f f, i, k, o p; and alſo ſix balls of three different ſizes, viz. two of each ſize; and likewiſe two coated electrical jars, and two coated glaſs tubes, viz. one of each fixed in each conductor. It muſt be obſerved, that the tubes e e e unſcrew only from the joint d; no attempts ſhould be made to unſcrew any other part, except the balls or points that may occaſionally be ſcrewed on at the other end: the ſame likewiſe muſt be obſerved of the tubes f f f, excepting that the tube to which g is fixed, may be unſcrewed out of the piece of wood which connects it to the flexible joint. g. f. h. Plate II.

CHAP. III.

DIRECTIONS FOR PUTTING THE PARTS OF THE ELECTRICAL MACHINE PROPERLY TOGETHER, AND PREPARING IT FOR USE.

1. HAVING lifted the machine out of the box by taking hold of the wood work of the glaſs cylinder A A, ſet it upon a table as repreſented Plate I. on which it is to be uſed, and faſten it there by means of the iron clamp a, Plate II.

2. The handle C, which is reverſed for the conveniency of packing the machine in a ſhorter box, is now to be reverſed to what it was when taken out of the box.

3. Now take off the cuſhion I, with its ſilk K, from the conductor R, which

is eaſily done by taking hold of the cuſhion, and drawing it towards that end of the machine which is fartheſt from the handle C: obſerve, before you take the cuſhion off, how it is attached to the ſide of the conductor R, viz. by means of two braſs ſcrews, which are ſcrewed into the wood of the cuſhion, the heads of which are ſlipped in between the ſlits in the two pieces of braſs (that are blacked,) and ſoldered to the conductor R.

4. The cuſhion being off, take a clean, warm, dry, ſoft linen cloth, not very old, as they are apt to have the lint come off,* and wipe all the parts till they are very clean and free from damp or moiſture;† particularly the glaſs cylinder A A, and

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* Or any piece of ſilk or flannel, if it is made very dry and warm.

† *Note.* A ſmall quantity of *dry* chalk or whiting, rubbed on any of the cloths with which the machine and apparatus is wiped, will be found to be very uſeful in taking off the damp or moiſture which may adhere to any part of it.

the pillars B B and D D. This ſhould be done every time the machine is uſed, and likewiſe while it is uſing, if worked for any length of time. If the air be very moiſt or damp, or the machine has been kept in a damp place, (which ſhould be avoided, if poſſible) it will be proper to dry the whole machine gently, *except the cuſhion*, by placing it at a diſtance of about four feet from the fire; but this will be very ſeldom neceſſary, if the machine is uſed in a room with a fire. The cuſhion I, with its ſilk K, muſt alſo be wiped clean from duſt; and any amalgam which may looſely adhere to them, muſt alſo be wiped off; and if the weather is damp, or the machine has been kept in a damp place, the ſilk K ſhould then be gently dried before the fire, *but not the cuſhion* I, only the ſilk K of the cuſhion. The beſt way is to hold ſomething before the cuſhion, to keep the heat of the fire from it, when the ſilk K is drying. The wood of the cuſhion being *damp*, is no inconveniency, but rather an advantage.*

5. The cuſhion is now to be replaced, by ſlipping the two heads of the ſcrews under the two ſlits, in the pieces ſoldered to the conductor R, § 3. always obſerving that the ſilk K lies on the glaſs cylinder A A, ſo that the edge of the ſilk K, fartheſt from the leather cuſhion, to which it is either glued or paſted, may be near the points M, viz. within about half an inch; but obſerve that the edge of the ſilk muſt not touch the points. If it does, it muſt be cut ſhorter. See Plate III. Fig. 2.

Now gently preſs the cuſhion with the ſilk againſt the glaſs cylinder A A, by moving the ſlider F further under the board E, and fixing it there by the ſcrew L. See L. Chap. I.

6. Next obſerve that one of the braſs rings of the iron chain b, hangs on the braſs

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* *Note.* Sometimes the table and the floor is ſo dry as to prevent the cuſhion from being ſupplied with the electrical fluid from the earth. In that

knob H of the conductor R, the other end reſting on the table.

7. Turn the ſilk from off the glaſs cylinder A A, back on the conductor R.

8. The machine being prepared according to the foregoing directions, take one of the pieces of card c, Chap. II. and Plate II. with the leather glued on it, on which ſome amalgam is ſpread ;* rub the amalgamed part of the leather on the glaſs cylinder A A, about ten or twelve times backwards and forwards, in the direction of its length, on that part which is near the

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caſe, the chain b, hanging from either conductor, muſt be connected with a quantity of metal, ſuch as the fire-grate in the room, or leaden pipes communicating with water or moiſt earth.

[*] The amalgam is made by melting five parts of mercury with one of zink; and when cold, is mixed with any kind of fat. I commonly uſe hogs lard, about a fortieth part of the whole weight.

If ſometimes the amalgamed leather on the card c, Chap. II. and Plate II. be rubbed over with a very ſmall quantity of hogs lard, or any greaſe, as the end of a tallow candle, &c. before freſh amalgam is ſpread over the ſaid leather, it will be found to be of ſervice towards exciting the cylinder when rubbed again with the freſh amalgam on it.

the cuſhion; at the ſame time gently turning the handle, ſo that the upper part of the cylinder may paſs from the cuſhion towards G, the oppoſite conductor. This is to be underſtood in all caſes where the cylinder is directed to be turned.

9. The cylinder A A. being now ready to be excited, replace the ſilk as directed § 2 and 5, and turn the cylinder A A. The ball h, being ſcrewed at the end of one of the tubes f, apply it about an inch or two from the conductor G, and ſtrong ſparks will be received on the ball. See Plate I. If every thing be dry and in order, the machine will be found greatly to exceed any electrical machine of the ſame ſize yet made.

10. The method of applying the amalgam, § 8, muſt be repeatedly uſed whenever the electricity becomes weak; and it will be proper, when the machine is uſed for a conſiderable time at once, to take the cuſhion ſometimes from the conductor R, and wipe

the cylinder A A, and wipe off any amalgam which may looſely adhere to the ſilk, and alſo the mercury of the amalgam, which often paſſes through the ſilk, in fine particles, on to the leather of the cuſhion.*

11. By often rubbing the amalgamed part of the leather c againſt the cylinder AA, the ſurface of the amalgam will become ſmooth and dry; ſo that, after being uſed ſome time, the glaſs cylinder will not be excited ſo ſtrongly, when rubbed with it. In this caſe a ſmall quantity of freſh amalgam, not more than the ſize of half a ſmall pea, muſt be taken out of the box marked *Amalgam*, and ſpread on the leather,

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[*] It will be found to be an advantage, ſometimes to uſe one cuſhion, and ſometimes the other, there being always two ſent: alſo, turning the glaſs cylinder ſometimes backwards, viz. the contrary way, about eight or ten times (having firſt turned the ſilk back), is likewiſe found to be of advantage towards exciting the glaſs cylinder, when turned again, as uſual, with the ſilk on the glaſs cylinder.

leather, and applied as before; by which means the cylinder may always be excited very ſtrongly, and the quantity of amalgam in the box will laſt a long time.

12. The ſtrength of the ſpark is regulated by means of the different ſized balls: that is to ſay, if very ſtrong ſparks are required, the largeſt ball muſt be uſed; if rather weaker, the next ſmaller ones; and, if very weak, the ſmalleſt balls, or the metallic points: or if weak ſparks are required from either of the balls, the *ſilk* of the cuſhion muſt be turned back over the conductor R, and kept there, by laying ſomething on the upper part of the cuſhion.

13. If the machine is required to produce its greateſt effect, it ſhould be uſed in a dry warm room; for it is a fact well known to electricians, that if the air be moiſt, the moiſture will conduct the electricity away almoſt as ſoon as it is excited.

14. If at any time the ſilk K of the cuſhion I ſhould be damaged, it may be eaſily replaced by gluing on a new one of the ſame dimenſions in its place. Obſerve particularly, that the edge of the new ſilk reaches *within* about half an inch of the points M, when laid on the cylinder. See Plate III. fig. 2. The ſilk is only common black mode, about four or five ſhillings a yard.

15. If an accident ſhould happen to any part of the electrical machine, it can be replaced without ſending the other parts.

16. The cylinder A A ſometimes gets a number of little black ſpots, by the greaſe and amalgam ſticking to it: this may be wiped off with a dry linen cloth or a piece of ſilk, firſt rubbing the cylinder gently, in the direction of its length, with a piece of ſand, emery, or glaſs paper, or a piece of fiſh-ſkin, or wiping the cylinder with a cloth dipped in ſoap ſuds.

17. If the axis and pivot upon which the glaſs cylinder turns, ſhould at any time want greaſe, the cylinder may be taken out of its frame by unſcrewing the two ſcrews at the top of the glaſs pillar near the handle, and may be replaced after applying the quantity of greaſe required.

CHAP. IV.

OF THE USE AND APPLICATION OF THE PATENT ELECTRICAL MACHINE TO MEDICAL AND PHILOSOPHICAL PURPOSES.

HAVING deſcribed the electrical machine and apparatus, and alſo given directions for preparing the machine for uſe, it will now be proper to give directions for their application.

1. It is univerſally allowed that the electrical fluid can be rarefied or condenſed.

2. This electrical machine, therefore, may not be improperly called a machine for rarefying or condenſing the electrical fluid.

3. The glaſs cylinder A A, by rubbing againſt the ſilk K, that is between the cuſhion I and cylinder A A, is continually

depriving, not only the cuſhion of its electricity, but alſo the conductor R, connected with it. This is as conſtantly ſupplied from the earth, or common ſtock, by the chain b, while it hangs from the conductor R to the table. The electricity, thus drawn from the earth up the chain b, to the conductor R, and cuſhion I, is ſuperinduced or condenſed on the conductor G. If now the knuckle, or any other blunt conducting ſubſtance, be applied within the ſtriking diſtance of the conductor G, then G will give or part with the electricity ſuperinduced or condenſed on it, to the knuckle, or any other blunt conducting ſubſtance oppoſed to it.

4. But if the chain b is hung on the knob H of the other conductor, viz. G; then the cylinder, by rubbing againſt the ſilk, exhauſting, as before, the cuſhion I and conductor R, carries the electricity to the conductor G: but in this caſe it is not ſuperinduced or condenſed on it as before;

for the chain b, hanging from G to the table, which communicates with the earth, conveys it away to the earth, or common ſtock, as faſt as G receives it; ſo that G remains in its natural ſtate, and R is exhauſted more or leſs of its natural quantity of electricity.

Now if the knuckle, or any other blunt conducting ſubſtance, be brought within the ſtriking diſtance, an electrical ſpark will be received from the blunt conducting ſubſtance by R, to ſupply what it has been deprived of; and theſe ſparks will be continually received from the knuckle, or any blunt conducting body, brought within the ſtriking diſtance, while the cylinder A A is excited ſo as to exhauſt R; for which purpoſe, it is always requiſite that the chain b, hanging on G, ſhould make a communication between it and the earth.

5. But if the chain b is not hung either to R or G, neither of them will have

any communication with the earth, becauſe the cylinder A A, and the conductors R and G, are inſulated by means of the glaſs pillars B B and D D. Then, on turning the cylinder, the electricity will be exhauſted, as before, from I and R; and only that quantity of electricity which is contained in them, or part of that quantity, will be ſuperinduced on G; and this quantity, as it cannot get off from G to the earth, will be continually paſſing back again, under the cylinder A A, to that part which was exhauſted of it.

6. Whence it is obvious, that this machine, to uſe the common mode of expreſſion, is either a negative or poſitive one, and may inſtantly be changed from the one to the other.

7. It may alſo be made immediately to act on a perſon in the ſame manner as if he was electrified by two diſtinct electrical machines at one time, viz. with a poſitive and a negative one.

8. The conductor R, connected with the cuſhion, is that which is uſually called the negative one.

9. The conductor G is commonly called the poſitive one.

10. If the cylinder be excited while the chain b hangs on the knob H of the conductor R, and a perſon applies his knuckle, or any blunt conducting body, to G, within the ſtriking diſtance, he will then receive *poſitive ſparks* on the knuckle; or conducting ſubſtance, from the conductor G.

11. Or if a perſon be placed on the inſulated ſtool O, while it is connected with the conductor G, by means of the compound joint d, and the flexible joints f f f g. Plate IV. fig. 1. any other perſon ſtanding on the ground, preſenting his knuckle, or any blunt conducting body, to the perſon on the ſtool, will receive poſitive ſparks from the inſulated perſon.

12. But if the chain b be hung on the knob H of the conductor G, and a perſon

ſon applies his knuckle or any blunt conducting body near R, ſo that ſparks may paſs between it and the conductor, he is then *ſaid* to receive *negative* ſparks on his knuckle from the conductor R.

13. Or if the compound joint d, and the flexible joints f f f g, be applied to the conductor R, and connected with the inſulated ſtool in the ſame manner as it was before with the conductor G, and the chain b hung on the braſs knob H of the conductor G; if a perſon ſtands now on the inſulated ſtool, and ſparks paſs between him and any other perſon ſtanding on the ground, it is then *ſaid* that the perſon on the ground receives *negative* ſparks from the perſon on the ſtool.*

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* *Quære.* Is it not that real or poſitive ſparks paſs from the knuckle, or blunt conducting body, to the conductor R (or the *perſon* ſtanding on the inſulated ſtool) to ſupply that conductor (or the perſon ſtanding on the ſtool) of the electrical fluid they have been exhauſted or deprived of, by being connected with the conductor R, to which the cuſhion is attached?

14. In the following pages, ſpeaking of the conductors R and G, I have made uſe of the expreſſions Receiving and Giving, or words to that effect, inſtead of Negative and Poſitive. The propriety of this mode of ſpeaking is ſufficiently evident, from what has already been ſaid in the preſent Chapter.

15. Plate III. Fig. 1. repreſents the machine with the apparatus, as in uſe for receiving electrical ſparks from the arm without placing the perſon on the electrical ſtool.

16. But if the electrical ſparks, inſtead of being received *from*, are to be given *to* the arm, then d, with the apparatus, is to be put to the conductor G, inſtead of R; by placing the ſtem of d in the hole at the top of G; and at the ſame time hanging the chain on the braſs knob H, at the ſide of R, inſtead of the ſide of G, as when ſparks were to be received from the arm. It is obvious, that ſparks

may either be received from, or given to any other part by this apparatus, as it may be placed, by means of the joints, in any poſition, for that purpoſe.

17. Plate III. Fig. 2. repreſents the manner of drawing ſparks *from* and giving ſparks *to* the hand, exactly as if it was electrified at the ſame time by two diſtinct electrical machines, namely, what is called a poſitive and negative machine.

Among the many proofs of the circuit of the electric matter, an elegant one is afforded by hanging the chain on the knob H of either of the conductors in this experiment; for the paſſage of the electricity is immediately diſturbed by the communication with the earth, and ſparks paſs only between the hand and the conductor which remains inſulated.

18. By this apparatus ſparks may at the ſame time be drawn *from* any part, and given *to* any other part, without uſing the electrical ſtool: as, for example, ſuppoſe

them to be taken from the knee, and given to the oppoſite ſhoulder; in this caſe the ball that is connected with the conductor R muſt be directed to the knee, and the other to the ſhoulder, which is eaſily done by means of the joints.

The chain b muſt not be hung upon either conductor, when the electrical machine is intended to anſwer the purpoſes of two machines.

19. Plate III. Fig. 3, 4. is the ſame apparatus as in Fig. 1. but only repreſented in part, and with the conical points, inſtead of the ball: theſe are to be applied in the ſame manner as at Fig. 1. If the wooden conical point be uſed, then only the electrical aura or wind will be felt without any ſpark, and may be applied without the leaſt inconvenience even cloſe to the eye, as repreſented Fig. 3.

20. If the conical braſs point be uſed inſtead of the wooden point, then the electrical aura or wind will be felt, if the face,

or any other part, is at the diſtance of about five or ſix inches from it. If any part be brought near the conical braſs point, ſharp pungent ſparks will be felt.

21. The conical points may alſo be applied and uſed inſtead of the balls in every experiment where the balls are mentioned, the ſcrew of the conical point being the ſame.

22. Plate III. Fig. 5. repreſents the hand of a perſon directing the ball by means of the pliable joints and tubes fff, and glaſs handle K, to his leg, in order to give electrical ſparks to it; but if the tubes and joints had been connected with the other conductor, viz. R, then electrical ſparks would have been received from the leg, inſtead of being given to it.

23. Plate III. Fig. 6. repreſents a perſon directing the two balls by means of the pliable joints and tubes fff, and the two glaſs handles k k, in order to draw electrical ſparks from one ſhoulder, and at the

ſame time give them to the other, and that without ſtanding on the ſtool: theſe balls are readily directed to any other part, by means of the aforeſaid glaſs handles and pliable joints.

The two ſets of tubes with flexible joints may be ſcrewed together to make a greater length, if it is required to electrify a perſon lying in a bed.

Plate IV. Fig. 1. ſhews the manner of connecting the electrical ſtool with either conductor, by means of the tubes fff, with the flexible or pliable joints. Care muſt be taken that no part of them are near the table, by at leaſt five or ſix inches.

25. The arm repreſented in the Plate at Fig. 2. is ſuppoſed to be the arm of a perſon ſtanding on the electrical ſtool, and turning the cylinder at the ſame time, whereby he will receive more than his natural quantity of electricity, the ſtool being connected with the conductor G; and when the perſon applies his arm to the ball

h, within the ſtriking diſtance, he will then give to that ball the overplus of electricity he has received more than his natural quantity, by the ſtool on which he ſtands being connected with the conductor G.

26. If it is deſired that weak ſparks ſhould be drawn from a perſon when ſtanding on the ſtool, then the cord m ſhould not be connected with the wooden clamp l, repreſented as fixed to a chair, Fig. 2.; but if it is deſired to have ſtronger ſparks, then the braſs ring of the cord m muſt be connected with the ſtem of the joint d, and the other end reſt on the floor; and if very ſtrong ſparks are required, then the end, inſtead of reſting on the floor, muſt be connected with metal, ſuch as the grate, &c. in the room; and if very weak ſparks, the method mentioned § 12. Chap. III. may be uſed. There are other means of diminiſhing the quantity of electricity, which will occur to the practitioner.

27. If the ſtool be connected with the conductor R, and the perſon applies his arm as before, he will then receive a quantity of electricity from the ball h, to ſupply what he was deprived of by being connected with that conductor.

28. In Plate IV. Fig. 3. is ſhewn another method of receiving or giving ſparks *from* or *to* the leg or any other part, according to the conductor with which the ſtool is connected by means of the flexible joints, the perſon ſtanding on the ſtool, and turning the cylinder at the ſame time. This is done by means of the glaſs handle k, and one of the tubes f, with the piece g into which the ſhort ſtem of k is put: one end of the cord m is ſcrewed to the end of the tube which has the piece g, and the other part of the cord reſts on the floor. If the perſon is unable to hold the glaſs handles himſelf, the ſparks may be received *from* or given *to* him by another perſon ſtanding on the floor. Here alſo, if ſtrong ſparks

are deſired, the cord muſt be connected with metal, ſuch as the grate, &c. as before directed in § 26.

29. Plate V. Fig. 1. repreſents the manner of giving gentle ſhocks through the elbow, or any other part. § 2. Chap. VI. It is neceſſary, before you attempt to give the ſhock, to try the jar and tube, whether they are not broken; to do which, take the wire, with the ball and glaſs tube, out of the blacked cork of the large jar; and wipe the uncoated part of the large jar, and the glaſs tube, clean and dry; but the large jar is not to be taken out, being fixed in the conductor: then replace the glaſs tube, and put the wire with the ball into the hole in the cork, and hang one ring of the chain b on it, and the other ring put on the knob P on the board E. Then put the electrometer n, Plate II, into the hole on the top of the conductor, and ſlide the ball of n within a quarter of an inch to the knob H on the ſide of the conductor, and hang on

the chains and wire, as repreſented in Plate V. Fig. 1. except this difference, that inſtead of the ends of the chain being faſtened to the arm, as repreſented, they muſt be made to touch one another on the table. Then if the large jar makes a diſcharge between the ball of the electrometer and conductor with a few turns of the cylinder AA, it ſhews that jar is whole. By removing the wire with the ball from the cork into the glaſs tube, it may be tried in the ſame manner. If either jar or tube is very damp, or has the leaſt crack in them, there will be no diſcharge between the electrometer and conductor, if you turn ever ſo long.

The Machine being now ready for giving the ſhock, or vibrating motion; if ſmart ones are deſired, the braſs wire, with the ball, muſt remain in the hole in the cork; but if very gentle ones, ſuch as the moſt delicate conſtitution can bear, which is peculiar to the patent Electrical Machine, then the braſs wire is to be removed from the cork, and put into the glaſs tube that is fitted into the ſaid cork; and the communicator u is to be applied over the edge of the jar S, that one leg of it may touch the inſide coating of the jar S, and the other leg the outſide coating of the ſame jar. Plate V. Fig 1. It will be beſt that the communicator is put on that ſide of the jar which is furtheſt from the glaſs tube: the communicator thus connecting with the inſide and outſide coating of the jar, will prevent your receiving a ſmart ſhock from the large jar S, when preparing for gentle ones. *

In both caſes the electrometer muſt be regulated according to the ſhock or vibrating motion intended to be given: viz. if the ſmarteſt ſhock or vibrating motion of either jar or tube is wanted, the ball of the electrometer muſt be ſet at the furtheſt ſtriking diſtance

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* *Note.* When ſmart ſhocks or vibrating motions are required, the communicator is to be taken away from the jar S.

diſtance from the knob H at the ſide of the conductor; and if the gentleſt, the ball muſt be near the knob, but not touch it.

30. Plate V. Fig. 2. repreſents a perſon giving ſhocks along his leg; and in the ſame manner he may give it through any other part and in any direction, from the head to the foot, or from the foot to the head. In this caſe, he muſt have an aſſiſtant to turn the cylinder. An aſſiſtant will likewiſe be required in the operation of giving and receiving ſparks, as deſcribed § 23 of this Chapter.

31. A very denſe ſtream of electricity may be either received from, or given to any part of the body, by means of the jars when charged.

If the denſe ſtream is to be received by the conductor R, which is connected with the outſide of the jar therein, a chain is to be hung from the wire communicating with the inſide of that jar to the table: the chain b muſt be hung on the knob H of the conductor G. The jar being charged, on applying any part of the body to the conductor R, a denſe ſtream of electricity will go from that part of the body to the conductor R.

If the denſe ſtream is to be given by the conductor G to any part of the body, the chain that is hung on the wire of the jar in the conductor R, is to be taken from thence, and hung in like manner from the wire of the jar, that is in the conductor G, to the table; the chain b is to be removed to the knob H of the conductor R: the jar being charged, the conductor G will give a denſe ſtream of electricity to any part of the body preſented to it.

If the chain, inſtead of touching the table, be hung, by means of its two rings, from the ball of one jar to the ball of the other, the ſtream will in like circumſtances be exceedingly more pungent. This denſe electricity may be received from or given to any part of the body, by means of the apparatus already deſcribed, according as the chain b is hung on the receiving or giving conductor.

CHAP. V.

PHILOSOPHICAL EXPERIMENTS AND OBSERVATIONS.

1. THE intention of this Treatiſe not being to give a detail of the experiments relating to electricity, which are already well known, and amply deſcribed in other books; but rather to ſhew the convenience and advantage with which all experiments of this nature may be performed by the help of the machine which is now offered to the public patronage; this Chapter will not be very diffuſe and extended. For the ſake of beginners, I ſhall curſorily enumerate the laws, or leading phænomena

of electricity, and ſubjoin a few experiments that, for their novelty, ſingularity, or the conſequences to which they point, ſeem to deſerve particular notice.

2. The eaſieſt method of collecting a conſiderable quantity of the electric matter, is by rubbing two bodies together, by which means a condenſation or rarefaction of the electric matter is produced at the ſurface of one or both of the bodies. But it is not a matter of indifference what kind of ſubſtance is uſed for this purpoſe. Some bodies will ſcarcely produce electric appearances by any rubbing together, and others poſſeſs the property of becoming electrified in a ſurprizing degree by that means. Now thoſe bodies which, by friction or otherwiſe, become electrified in ſuch a manner, that their electric ſtate cannot be taken off by touching a ſmall part of their ſurface, are called electrics. Glaſs, ſilk, roſin, ſulphur, dry vegetable fibres, and common air, are the chief ſpecimens of this claſs.

3. Bodies, which, being by any means put into an electric ſtate, are capable of loſing that ſtate by the contact of another body at a ſmall part of their ſurface, are called Non-electrics, or, much more properly and frequently, Conductors. Metals, charcoal, animal juices, and water, are almoſt the only conductors we know of.

Every ſubſtance in nature is either an electric or a conductor. Since an electric cannot be deprived of its electricity at any part, without actually touching or approaching very near that part, it is evident, that the electric matter is not conveyed or conducted either though the ſubſtance, or over the ſurface of electrics. And ſince the whole electricity of a conductor may be taken away by touching any part thereof, it is likewiſe evident, that the electric matter does paſs either through the ſubſtance or over the ſurface of theſe bodies. The internal ſenſation of the ſhock, is one of the moſt obvious proofs that electricity paſſes through the ſubſtance of conductors.

4. The greateſt quantity of electricity is collected, when a perfect electric is rubbed by a perfect conductor. But there are circumſtances to be attended to, chiefly reſpecting the ſmoothneſs or roughneſs of the contiguous ſurfaces, which, for the ſake of brevity, cannot be enumerated and deſcribed here.

5. The electricity which an electric acquires by friction with a conductor, is obtained from the conductor; ſo that, if the conductor be inſulated, it will likewiſe become electrified, by loſing a part of its natural quantity, or by gaining a ſurplus, according as the electric body acquires what is commonly called a negative or poſitive ſtate. This has been in ſome meaſure explained in Chap. IV.

6. Bodies, in like and equal ſtates of electricity, repel each other; bodies in oppoſite ſtates attract each other; and bodies

in the mean or natural ſtate are attracted by all electrified bodies whatever.

7. If a thin electric plate, as, for example, glaſs, be electrified on one ſide, by friction or otherwiſe, and the other ſide be in contact with an uninſulated conductor, this laſt-mentioned ſide will aſſume an electric ſtate, of the contrary nature to that induced upon the former. In theſe circumſtances the glaſs is ſaid to be charged. The law of charging electrics, appears to be, that the ſum or whole quantity of electricity at both ſurfaces, is always either accurately or nearly the ſame. The following experiments, made with the Patent Electrical Machine, ſet this important principle in an obvious point of view.

8. Experiment I. Take off the ends of the two conductors R and G, and the included jars will be viſible, the wires with the balls being ſtuck in the cork of each. Hang the chain b on the knob H of R, and turn the cylinder. The jar

in G will not, in theſe circumſtances, become charged, excepting by means of a ſmall quantity of electricity, which will paſs from the ball of the jar into the air. But again, if the knuckle, or any other conductor, be applied near the ball of the jar in G, during the turning, ſparks will iſſue from it in abundance, ſtrong and frequent at firſt, but gradually leſs and leſs ſo, and the jar will become charged. The inſulated jar being diſcharged, does not then appear to be in an electrical ſtate on either ſide, except a ſmall reſiduum, which is not carried off by the diſcharge.

The like experiment may be made, mutatis mutandis, by hanging the chain on the knob H of the conductor G.

9. Obſervation. Hence is deduced the conſequence, that neither ſide of an electrical jar can be charged what is commonly called either poſitively or negatively, unleſs the other ſide be ſo ſituated, as to be able to aſſu me the contrary ſtate; and that the two

ſtates are equal in intenſity, becauſe they deſtroy each other in the diſcharge.

The electricity which paſſes off into the air, may perhaps make this conſequence leſs evident to thoſe who reaſon and think ſuperficially. It ariſes from the power of the machine; and in many other common machines is ſcarcely perceptible. If the ſilk of the cuſhion be thrown back, much leſs electricity will be driven off.

10. Experiment II. Take the chain b off from H, and hang it upon the wires of the jars in R and G, by means of its two rings. Turn the cylinder about ten times. The jars will be equally charged, as appears by ſeparately diſcharging them by means of the rod. If Nairne's new invented inſulated diſcharging rod t, Plate II. be uſed, the electric fire will be ſeen to paſs between the outſide and inſide of the jars, when they are diſcharged.

11. Experiment III. Repeat the laſt experiment with this variation, that, inſtead

of ſeparately diſcharging the jars, apply the luminous diſcharger from one conductor to the other. An exploſion will follow, and both jars will be at once, by that means, diſcharged. The iron chain connecting the inſides of the two jars, will, at the inſtant of diſcharging, be luminous; and alſo the inſide of the luminous diſcharging rod t, Plate II. will appear beautiful at the ſame time.

12. Obſervation. It is clear, from theſe two foregoing experiments, that two equal electrical jars may be charged without communication with the earth, by only altering the quantities of electricity at their ſurfaces. The machine exhauſts a quantity of the natural ſtock of electricity from the jar in R, and throws it upon the jar in G; while an equal part of the natural ſtock in the inſide of the jar in G, removes by the chain to the inſide of the jar in R. Thus both jars become charged, and may be ſeparately diſcharged. But if a

communication be made between the outſides, the equilibrium is reſtored; and at the ſame inſtant the ſurplus, which had removed from the inſide of one jar to that of the other, flies viſibly along the chain, to its original place. The paſſage of the electricity between the two outſides, may likewiſe be rendered viſible, if the luminous inſulated diſcharging rod t be made uſe of.

13. Experiment IV. The two foregoing experiments ſucceed in the ſame manner, when another chain is hung from one of the knobs H to the earth.

14. Experiment V. In the laſt experiment, if the chain, inſtead of communicating with the earth, be hung from the knob H to the wire of the ſame jar, the other jar only will be charged.

15. Obſervation. The charging of the jar in Experiment IV. whoſe outſide communicates with the earth, is a conſequence of the alteration which the ſtate of the inſides undergoes during the charging of the other jar. The uncharged jar, in Experi-

ment V, remains in its natural ſtate, becauſe its two ſides communicate by means of the chain. This jar may be regarded only as an inſulated conductor, which conveys the electricity from the inſide of the other jar to its outſide; and the experiment affords the ſame conſequence, with regard to a ſingle jar, as Experiments III. IV. do with reſpect to two.

Experiment VI. Hang the chain from the knob H of one of the conductors, the other end reſting on the table, and fit the electrometer to the other conductor. Hang the other chain from the electrometer to the wire of the jar in the conductor, to which the electrometer is fitted. Set the ball of the electrometer within the ſtriking diſtance from H, and turn the cylinder. The electricity will be diſcharged viſibly along the chain: but if the ball of the electrometer be placed cloſe to H, the jar will not become charged, and no ſpark will appear.

Obſervation. In this experiment, the jar in the firſt ſituation becomes charged, by the inſide aſſuming, by means of the air, a ſtate contrary to that ſuperinduced on its outſide; and the diſcharge ſhews the paſſage of the electricity in reſtoring the equilibrium. In the latter ſituation it is proved, that the inſide, by its communication with the outſide, not being allowed to aſſume the contrary ſtate, the jar cannot be charged.

It is preſumed that the following uncommon experiments will be acceptable to the curious.

16. Experiment VII.* To make a number of ſmall holes in a glaſs tube. Stop one end of the tube with a cork, and pour a quantity of ſallad oil into it. Stop the other end with a cork, through which is previouſly inſerted a wire, whoſe lower end is pointed, and bent at right angles to

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* This experiment was communicated by the Rev. Mr. Morgan, of Norwich.

its length, and its upper end turned into a hook. Let the inner end of the wire be below the ſurface of the oil; and hang the whole apparatus upon the knob H of one of the conductors. Then, if the conductor be electrified by turning the machine, and the finger, or any other uninſulated conductor, be brought near the lower end of the wire in the tube, a ſpark will paſs to it through the oil and glaſs, making a ſmall hole.

This experiment affords ſome beautiful appearances when tried in the dark, and on many accounts appears to be very fruitful in conſequences.

17. Experiment VIII.* To make the ſoft Dutch ſealing-wax aſſume the appearance of wool.

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* This experiment occurred to me, on trying the experiments mentioned in Nicholſon's Introduction to Natural Philoſophy, Vol. II. page 388. All the other experiments, except Experiment VII, are original.

Take a piece of ſealing-wax, about an inch long, or leſs, and ſtick one end of it on the copper ball. Screw the ball to the joint; place the ſtem in the hole of one of the conductors, and hang the chain on the knob H of the other. In this ſituation warm the wax gently with a candle, till it is almoſt ready to drop. Remove the candle, and immediately excite the cylinder; at the ſame time holding the other copper ball, ſcrewed to the end of the tube f, at about twelve inches diſtance from the wax. The electricity will immediately throw the wax upon the other ball in ſeveral very fine threads, which being wiped off with the finger, are ſcarcely diſtinguiſhable from red wool.

18. Experiment IX. To cauſe the mercury in a thermometer to riſe by means of electricity.

Take a mercurial thermometer, with a ſmall bulb. The wooden ſcale muſt be ſo ſhort, as not to reach down to the bulb by about three inches, which ſpace will therefore be entirely clear. Prepare the machine as repreſented Plate III. Fig. 2. excepting that, inſtead of the copper balls, there muſt be ſubſtituted two balls of ſoft wood, about two inches in diameter. Suſpend the thermometer ſo that its bulb may be immediately between the balls, which muſt not be more than half an inch aſunder. Excite the cylinder, and a ſtream of electric matter will paſs between the balls. The mercury will inſtantly begin, and continue to riſe, till it exceeds its former height very conſiderably. I have raiſed it from 67 to 99 degrees of Fahrenheit's ſcale. The ſpirit thermometer is affected in a ſimilar manner by the ſame treatment.

19. Experiment X. The ſpark given to a conductor, in what is called a negative ſtate, is much more pungent than the ſpark received from a ſimilar and equal conductor, in an equal poſitive ſtate.

The proof of this by the Patent Machine, is too obvious to need any particular inſtructions.

The different figure of the ſpark appears to be the proximate cauſe of the phænomenon. For the ſpark proceeding from a poſitive conductor, is emitted from a ſingle point of the ſurface; but when it has proceeded about one third of its length, it becomes divided into many radiations, ſpringing from a kind of luminous ſpeck. It does not therefore enter the hand of the obſerver at one, but at many points of the ſurface; and conſequently its effects are divided and weakened. But the contrary happens when the conductor is in what is called a negative ſtate, the ends of the ſpark being as it were reverſed. The paſſage of the electricity is made through a ſingle point, or ſmall part of the ſkin of the obſerver, and the irritation becomes much greater.

Experiment XI. To cauſe the charge of three ſquare inches and a half of coated glaſs to fly through the air in a denſe ſpark of five or ſix inches in length.

Take off the ends, N N, of the conductors R and G. Remove the wires with balls from out of the corks withinſide the jars; and put them in the ſmall coated glaſs tubes that are in the corks; and hang the chain b from one wire to the other. Turn the cylinder; and, reſting one ball of the inſulated diſcharging rod upon the conductor G; bring the other ball towards the conductor R. If the machine be dry and in a good ſtate, the diſcharge will fly, in denſe ſparks of more than ſix inches in length, from the ball of the diſcharging rod to the conductor R. But if, on the contrary, the one ball of the diſcharger be reſted on the conductor R, and the other ball brought towards the conductor G, this laſt ball will draw off the electricity (ſuperinduced on G), with a ruſtling noiſe, at the diſtance of ſix inches or more, and will not produce a ſpark till the diſtance is very ſmall.

CHAP.

CHAP. VI.

MEDICAL OBSERVATIONS.

1. THERE can be no doubt, ſince the electric matter is found in all bodies, but that it is an univerſal and principal agent in the ſyſtem of the world. Much remains to reward the aſſiduity of future diſcoverers. Electricity is yet in its infancy; but, like the other branches of philoſophy, its infancy has been embarraſſed by a number of theories, contrived by men who prefer the effuſions of fancy to the ſlow though ſure method of experiment and obſervation. General inferences, drawn from experiments which were either few, inaccurate, or falſe, have in many inſtances diſgraced the ſciences. The influence of electricity on the animal frame has

never been diſputed; but the ſucceſs of its application to the cure of diſorders has been exceedingly magnified by ſome writers, and as much ſlighted by others. The common ſource of both theſe oppoſite opinions may be attributed to the ſuperficial obſervations of thoſe who held them. But it is now eſtabliſhed from a multitude of facts, that electricity is almoſt a ſpecific in ſome diſorders, and deſerves to be held in the higheſt eſtimation for its efficacy in many others. It is not intended in this ſhort treatiſe to give any circumſtantial account of the caſes upon which the following part of this chapter is grounded; but the reader may depend upon it, that it contains not a ſingle aſſertion which has not been confirmed either by the author's own experience, or the teſtimony of a numerous acquaintance of ingenious and worthy gentlemen, who are ready to promote any undertaking which is intended to advance the public good.

2. The early method of applying electricity conſiſted in giving large ſhocks from jars of very conſiderable magnitude. (See Note on § 3.) This practice is at preſent diſcontinued; and an opinion ſeems to prevail, that the gentler methods of ſimple electrization, ſuch as receiving or giving the electric aura or wind by wooden or metallic points, and alſo the ſparks either on the ground or electrical ſtool as circumſtances may require, are ſufficient in all thoſe caſes in which electricity can be uſed with advantage. It is difficult for one who thinks he has made a diſcovery, to avoid running into extremes; and perhaps, upon reflection, we ſhall not find reaſon entirely to exculpate thoſe who ſo ſtrenuouſly recommend thoſe very gentle methods. It is certain, that the adminiſtering of ſhocks has done ſervice in caſes in which ſimple electrization has not been found effectual; and therefore it would be injudicious to attempt to eſtabliſh any general rule for

excluding them. And on the contrary it muſt be granted, not to mention the diſagreeable ſenſation to the patient, that very ſtrong ſhocks are ſometimes injurious, and, if they do not produce an immediate good effect, are often found to be of very little ſervice when continued. The medium ſeems preferable; that is to ſay, to begin with ſimple electrization, and to proceed gradually, as may be thought neceſſary, either to receive or give the electric matter by metallic or wooden points; or the ſparks, by rubbing a metallic ball quickly backwards and forwards over a part of the body covered with a woollen cloth; to receive or give ſparks of different ſizes, when either placed on the ſtool, or ſtanding on the ground, as directed § 12. Chap. III. or § 28. Chap. IV; to draw the denſe ſtream as directed § 31. Chap. IV; or to give gentle ſhocks, which may be either general, or confined to a particular part, as deſcribed § 29 and § 30, Chap. IV.

A little experience will enable the operator to judge the proper degree of electricity; and the Patent Machine is peculiarly applicable to every known method of applying it.

3. The opinions of the Faculty are divided concerning the mode of action which electricity exerts on the human frame. By ſome it is thought to relax univerſally, and by others to be ſtimulant and bracing. Both opinions ſeem to agree with the facts. Electricity, applied in the gentleſt manner, appears to be ſedative and relaxing; and in the ſtronger methods it may naturally be ſuppoſed to ſtimulate.* But it is an advantage, that we are not under the neceſſity of waiting till a theory is eſtabliſhed, before we can receive benefit from

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* *Note.* Thoſe whoſe caſe may require rather ſtrong ſhocks, may remove every fear they have of being injured by them; the Patent Electrical Machine being ſo conſtructed, that the ſtrongeſt ſhock that can be adminiſtered by it, can no way detriment the moſt delicate conſtitutions.

the powerful, though ſafe, application of electricity.

3. The very many cures performed by electricity in the hands even of perſons entirely unſkilled in medicine, and its never having produced any ill effects when applied with moderate degrees of force, give it an advantage which perhaps no other remedy is entitled to claim. It may be laid down as an eſtabliſhed fact, that electricity judiciouſly applied has never done hurt. A healthy fibre is never injured by it: it may conſequently be conveyed without any difficulty or apprehenſion to the ſeat of any local diſorder, as it may be paſſed, without any diminution of its virtue, through the intervening ſound parts.

5. Simple electrization, or ſtanding on the ſtool, is affirmed to increaſe the circulation of the blood, and promotes glandular ſecretion.

6. The various applications of electricity are particularly ſerviceable in obſtructions

tions. In many diſorders, whoſe remote cauſes are of this nature, its action and effects are beyond expectation. The ſuppreſſion of the catamenia and all its conſequent evils are removed to almoſt an abſolute certainty, by paſſing the electric matter through the region of the pelvis. Very many inſtances of patients relieved from the moſt hopeleſs ſituation, conſpire to recommend this remedy as ſpecific in ſuch caſes; and the advantages mankind may reap from it are ſo much the more valuable, as the Materia Medica furniſhes us with few medicines at all adequate to the purpoſe. The method of adminiſtering electricity for theſe diſorders is to place the patient between the two balls h h, Fig. II. Plate III. placed on oppoſite ſides of the waiſt; and accordingly as the ſenſation is more or leſs diſagreeable, the balls muſt be removed nearer to or farther from, the body. In ſome inſtances, the points may be ſubſtituted inſtead of the balls. Care muſt be taken to be aſſured, that the patient is not pregnant; and the electricity ſhould rather be too weak than too ſtrong, for fear of producing an immoderate flow.

7. Nervous diſorders in general give way to gentle electrization, but are ſometimes aggravated by the application of too great a force. Nervous head-aches are often mitigated and entirely relieved by the electric wind from a metallic or wooden point, applied at a diſtance oppoſite the temples, and ſucceſſively round the head. The effects of too much irritation are ſo exceedingly diſagreeable, that great attention muſt be had to make trial firſt of the mildeſt methods.

8. In recent bruiſes, burns, ſcalds, or any other local pain of no long ſtanding, numberleſs inſtances eſtabliſh the immediate efficacy of electricity. The electric wind or ſparks may be uſed in theſe caſes.

9. The natural ſecretions are promoted by electricity, and thoſe which are adventitious

titious or unnatural are retarded and often ſuppreſſed. The latter effect ſeems to be a conſequence of the former; for moſt unnatural diſcharges are cauſed by the obſtruction of ſome natural ſecretion or circulation which ought to have been performed. Thus the proximate cauſe of the purulent diſcharges of ulcers, &c. is either the ſtoppage of the circulation or the perſpiration of the part, whoſe veſſels are inflamed or obſtructed; and if electricity be poſſeſſed of power to promote a proper circulation through the finer paſſages, the vicious diſcharge muſt ceaſe of courſe. It ſeems to be a good method in ſuperficial complaints to adminiſter the aura or ſparks; but in diſorders which principally affect the interior part of the body, gentle ſhocks are to be preferred.

10. Blood-ſhot, and other inflammations of the eyes, are almoſt always cured by the electric wind. The fiſtula lachrymalis has been cured, in many inſtances, by the ſame

treatment. And there are not a few remarkable caſes, in which blindneſs, whether ariſing from an opacity of the cornea, or the inſenſibility of the retina, has been removed by electricity, applied either in the form of wind or ſparks to the eye itſelf, or ſhocks paſſed near the eye. But it muſt be confeſſed, that it has failed in many other inſtances of this laſt kind.

11. The tooth-ache, ariſing from cold, is generally cured by drawing the ſparks from the outſide of the face oppoſite the tooth. A ſhock properly directed through a tooth beginning to decay, frequently takes away the pain by deſtroying the ſenſibility of the end of the nerve.

12. The ſore throat is very often cured by drawing ſparks; and the ſame method is frequently ſucceſsful in diſpelling glandular tumours, even of the greateſt magnitude. Generally ſpeaking, all ſwellings which do not contain matter are diſperſed by electricity; and thoſe which do, are bene-

fited by it. Cutaneous eruptions are often cured by the electric wind.

13. Deafneſs from cold, from too much wax, or proceeding from a fever, ſeldom fails of being removed by the electric aura, by drawing ſparks, or by gentle ſhocks from one ear to the other.

14. Sprains, cramps, contractions, among which the locked jaw ſtands confirmed by many ſucceſsful caſes, and few to the contrary; rheumatic pains, whether local or otherwiſe; are all peculiarly within the province of the electrical operator, as they have been conſtantly removed with ſcarcely any exception. The method is, to uſe repeated gentle ſhocks through the part affected, and increaſe the force till ſucceſs attends: but in theſe, as in all other caſes, the feeling of the patient muſt be conſulted; for ſhocks that have been given from very large jars, have been frequently found to be very diſagreeable, without being effective: but ſuch attention has been paid in

the conſtruction of the Patent Electrical Machine, that the ſtrongeſt ſhocks requiſite for any diſorder may be given, by this machine, without any danger to the perſon requiring them.

15. The ſciatica, the proper gout, and the palſy, have been often cured by electricity, applied according to the various degrees. The firſt of theſe diſorders is much more capable of relief from electrical treatment than the other two. It is thought by ſome, that there is danger of repelling the morbid matter of the gout from the extremities to the nobler parts; but this opinion does not ſeem to have any ſolid foundation. In recent palſies, much good has been done, even on patients far advanced in years; but palſies of long ſtanding, though relieved at firſt, are ſeldom effectually cured. The moſt judicious method appears to be that of firſt drawing ſparks from the diſeaſed part, and afterwards to give ſhocks confined to the part, rather ſtrong at firſt,

but weaker as the ſenſe becomes more acute.

16. Conſiderable cures have been performed by electricity in epileptic and hyſterical caſes. A few gentle ſhocks adminiſtered during the fit from arm to arm through the cheſt, almoſt infallibly removes theſe diſorders; and a daily continuation of the remedy for ſome days after, has prevented the return in many caſes in which the diſorder had long been habitual. When the period is known, or the approach of a fit can be predicted, a few gentle ſhocks may perhaps avert the evil.

17. Agues are cured by adminiſtering ſhocks through the cheſt and ſides, or croſs-ways, from each hand to the oppoſite foot, juſt before the fit is expected. This diſorder is commonly cured by a very few times electrifying.

18. The Patent Electrical Machine is ſuperior to others, by the means it affords of trying the medical effects of electricity,

as you may either give it to any part of the body, and at the ſame inſtant receive it from any other part. See § 17, 23. Chap. IV. and Plate III. fig. 2, 6; and if the inſulated ſtool O be connected with the conductor R, by means of the metallic tubes f f f, and compound joint d, a perſon ſtanding on the ſtool, and touching the conductor G, may make the electrical fluid to circulate through him, or any part of him, as long as he pleaſeth; previous care being taken that the chain b is removed from either of the conductors, and that the metallic tubes touch not the table. And if connected only with the conductor R, the chain b being hung on the braſs knob H of the conductor G, he may keep himſelf in an exhauſted ſtate of electricity; and *vice verſâ*, being conducted only with the conductor G, and the chain removed to the braſs knob H of the conductor R, he may keep himſelf in a condenſed ſtate of electricity. See fig. 1. Plate IV.

19. The very ſudden cures which are daily performed by electricity, and the exaggeration which is made in relating facts by thoſe who are fond of the marvellous, have led many patients into an expectation, that their diſorders will vaniſh as it were by enchantment, when they are electrified. It is not enough for theſe miſtaken people to be informed, that electricity, both for its univerſality and efficacy, deſerves to ſtand firſt in the liſt of remedies; but they require it to work miracles. For this reaſon, and to prevent the diſcouragement which the diſappointment of their unreaſonable expectations may cauſe, it is neceſſary to obſerve, that inſtantaneous relief muſt not always be expected; and that ſeveral diſorders, which were not ſenſibly affected by a month or more electrization, have in time been cured by perſevering in the uſe of the remedy. It is probable, that many of the caſes in which electricity has failed, would have been crowned

with ſucceſs, if the opinion of its inefficacy had not been too haſtily adopted.

20. The reader, who may be inclined to think the aſſertions contained in this chapter, ſtand in need of the ſupport of the facts, is referred to the Philoſophical Tranſactions; Becket's Eſſay on Electricity; Cavallo's Eſſay on the Theory and Practice of Medical Electricity; Birch's Conſiderations on the Efficacy of Electricity, in removing Female Obſtructions; New thoughts on Medical Electricity, or an Attempt to diſcover the real Uſes of Electricity in Medicine; Symes's Fire analyſed; Lovett's Subtil Medium proved; and Weſley's Deſideratum; in all which he will find a variety of well-atteſted caſes.

⁂ The number of applications which have been made to Mr. Nairne, by patients deſirous of receiving the benefit of medical electricity, renders it neceſſary for him reſpectfully to inform the public, that his other avocations make it impoſſible for him to attend to any applications of that nature.

When leiſure permits, Mr. N. propoſes to publiſh ſome papers on electricity, formerly communicated by him to the Royal Society, and which have been ſince printed in the Philoſophical Tranſactions. The references are as follow: Experiments on metals, animals, and vegetables, Vol. 64; on the advantage of elevated pointed conductors, Vol. 68; on the effect of electricity in ſhortening wire, Vol. 70; an account of the ſame effect produced by lightning, Vol. 72.

PLATE.1.

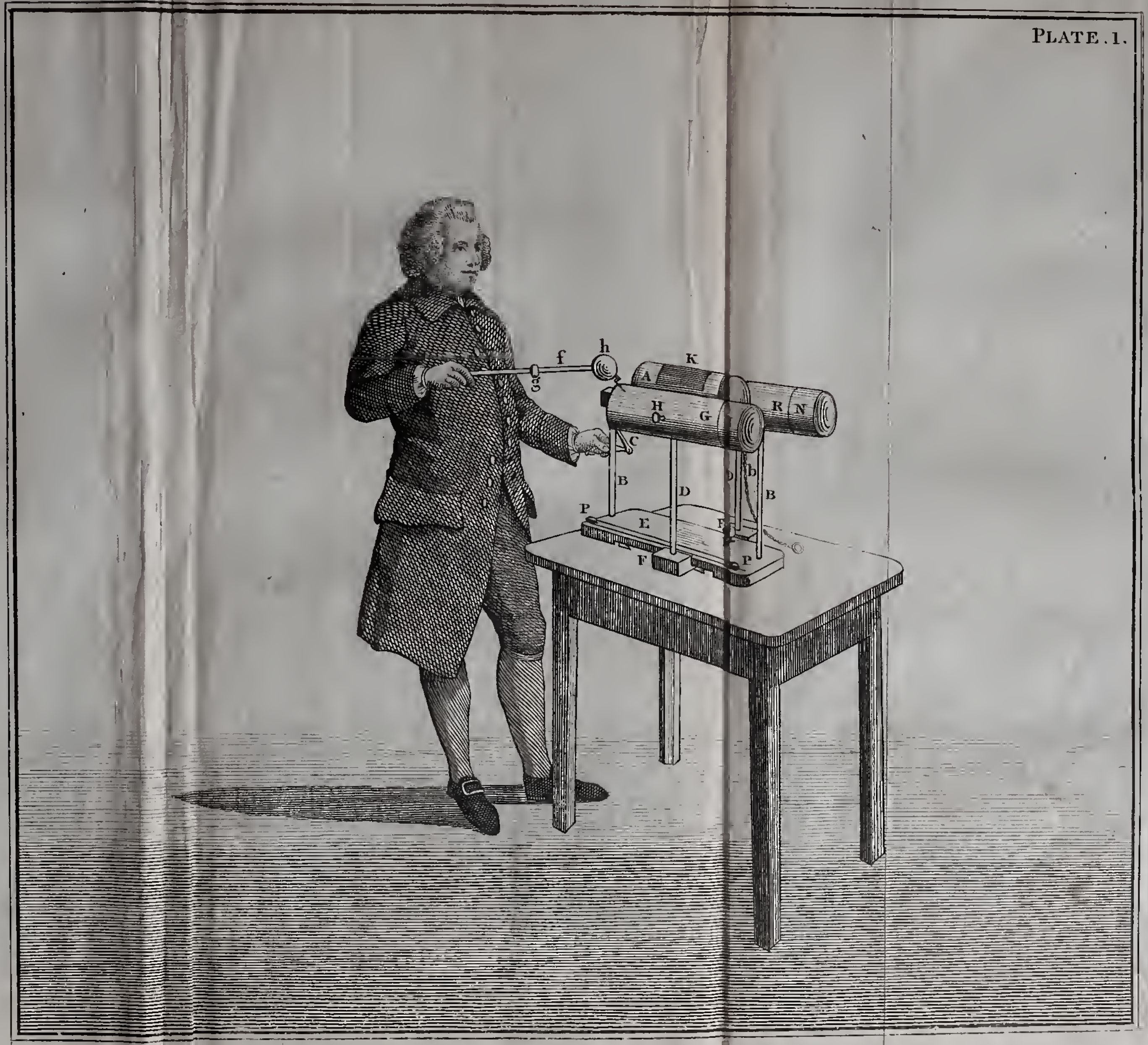


PLATE. II.

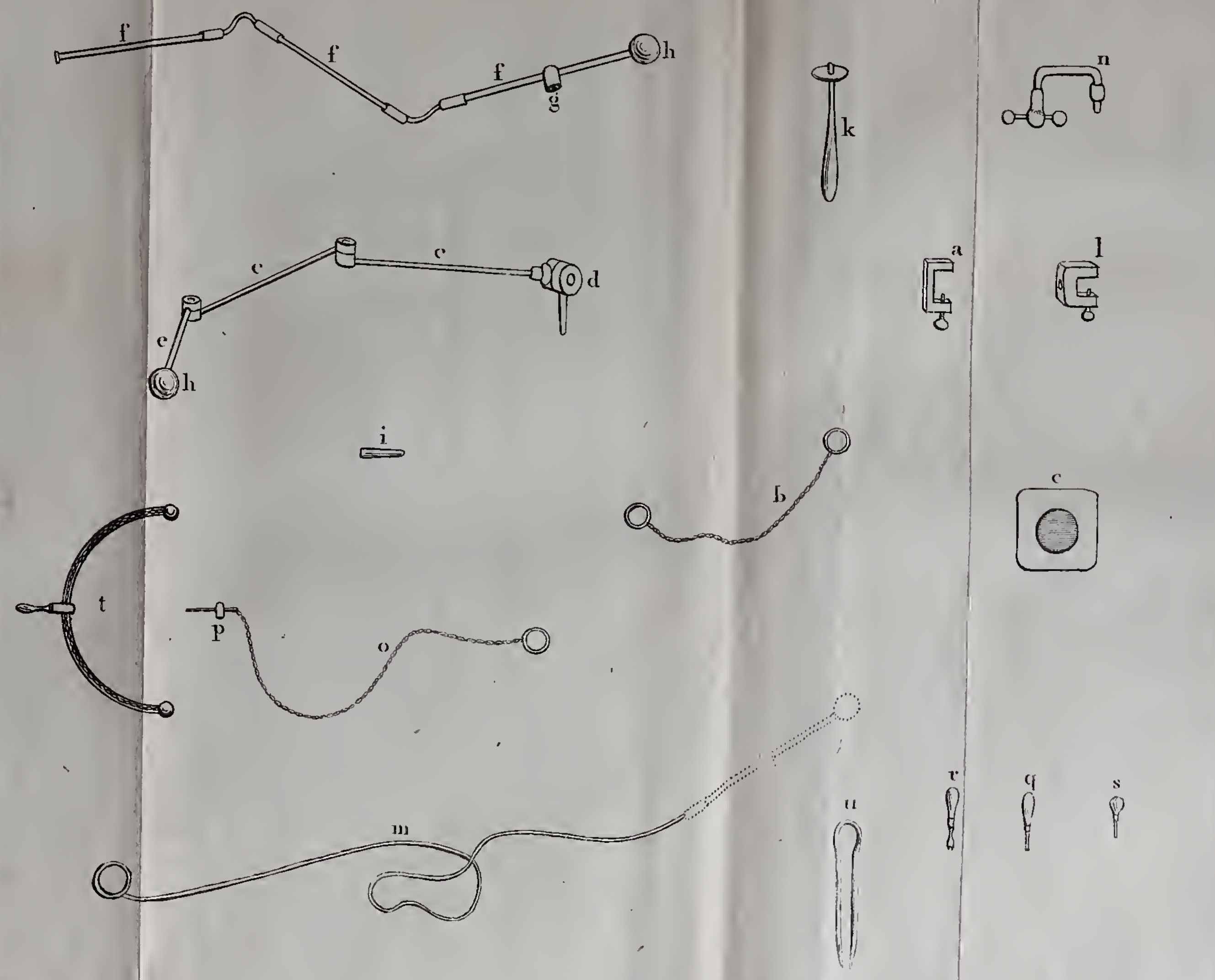


PLATE. III

Fig. 2.

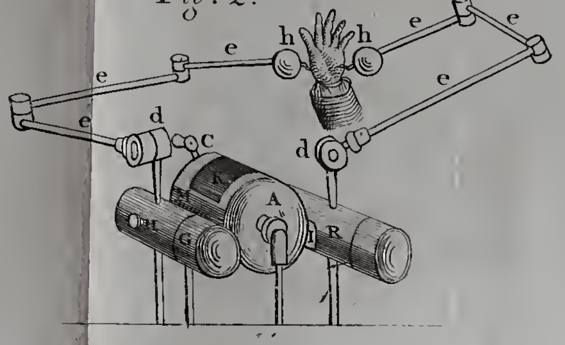


Fig. 5.

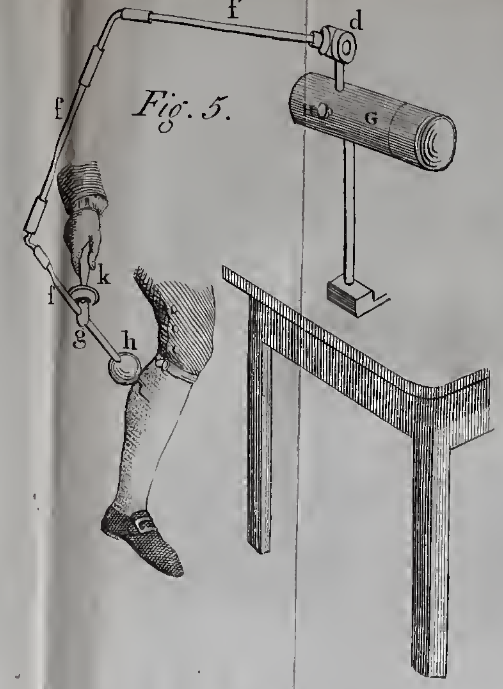


Fig. 3.

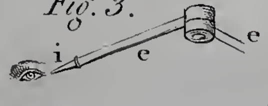


Fig. 1.

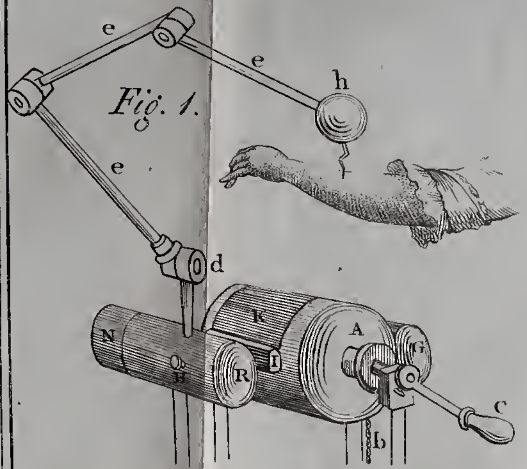


Fig. 4.

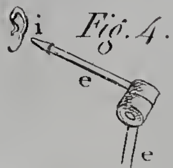


Fig. 6.

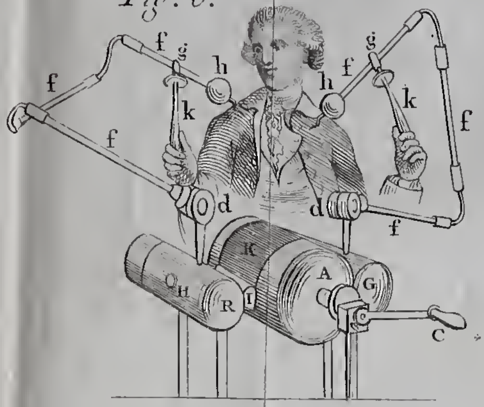


PLATE. IV.

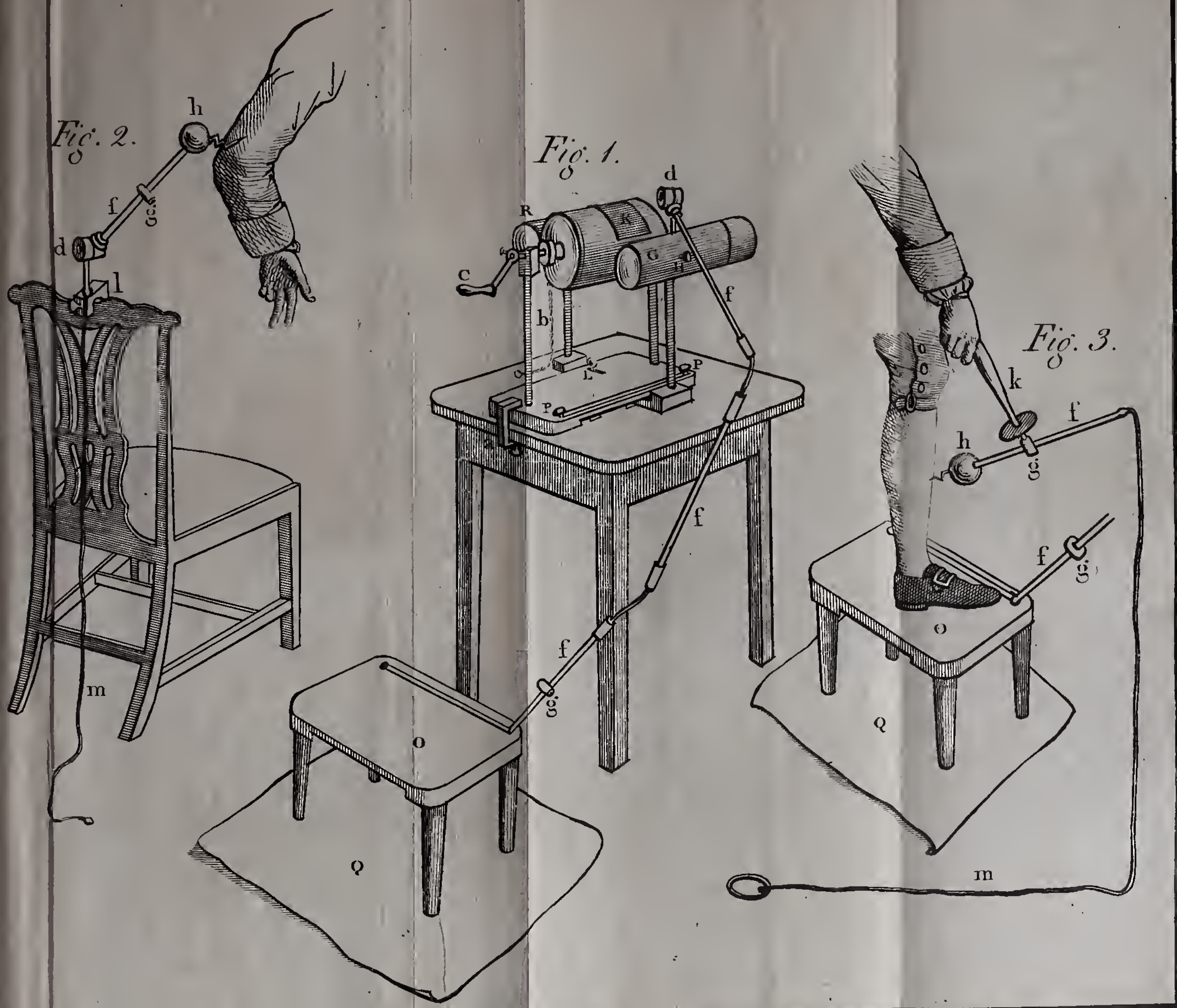
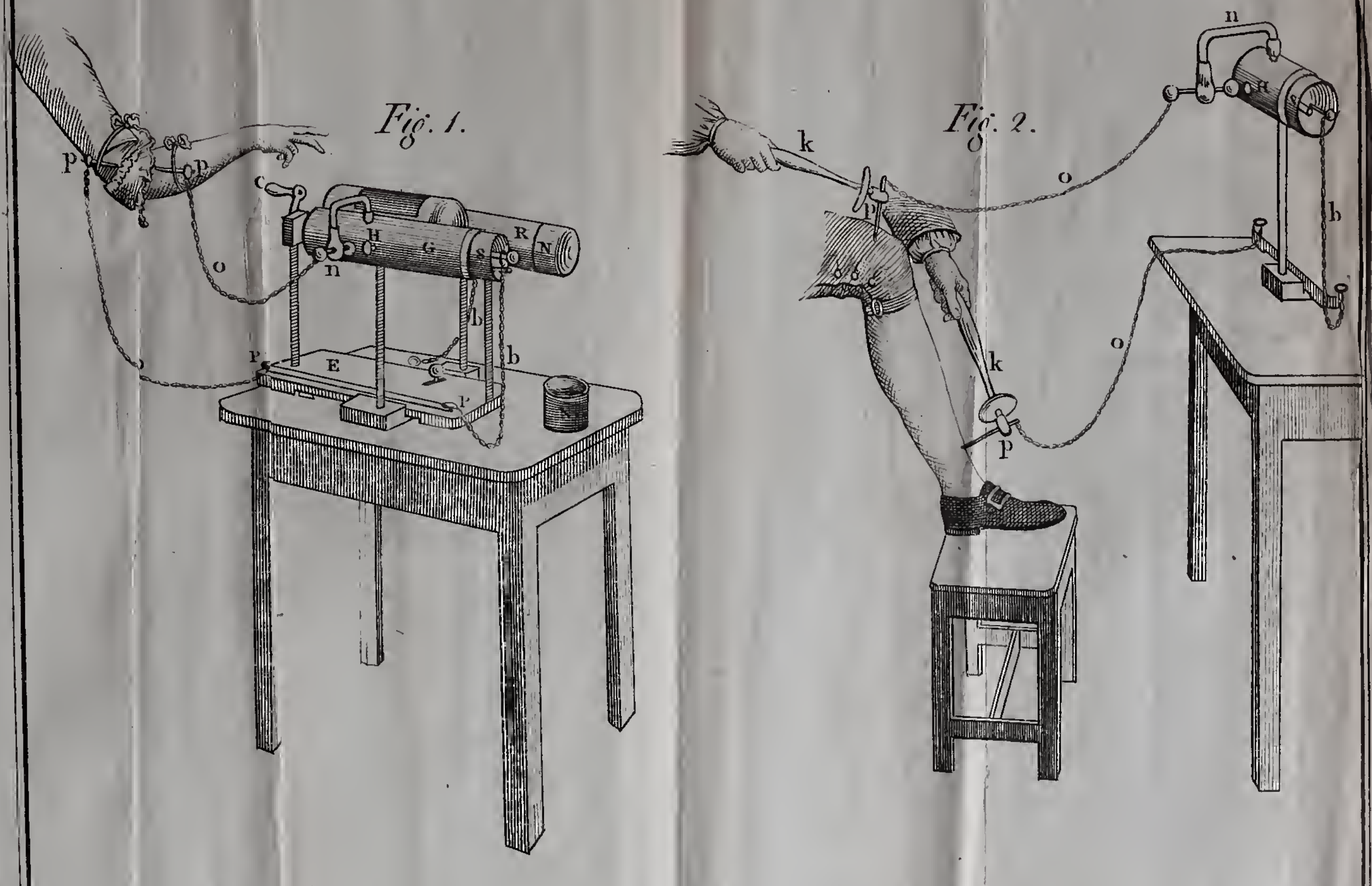


PLATE. V.



PRICES of *NAIRNE*'s PATENT ELECTRICAL MACHINES, and ſome of the various PHILOSOPHICAL, MATHEMATICAL, and OPTICAL INSTRUMENTS, made and ſold by NAIRNE and BLUNT, No. 20, in *Cornhill*, oppoſite the *Royal Exchange*, London.

Electrical Inſtruments.

	£		
A Patent Medico-Electrical Machine, Cylinder about five Inches Diameter, with two Conductors, a Medical Jar and Tube in one Conductor, Electrometer, two Sets of Flexible Tubes and Joints, two inſulated Handles; a Pair of Directors for giving gentle Vibrations or Shocks, through any Part of the Body; three Pairs of different ſized Metal Balls; two Braſs and two Wood Conical Points, Chains, Clamp, and Box of Amalgam—in a coloured Deal Box	5	5	0
A Patent Medico Electrical Machine, Cylinder about ſeven Inches in Diameter, with two Conductors, a Medical Jar and Tube in one Conductor, Electrometer, two Sets of Flexible Tubes and Joints, two inſulated Handles, a pair of Directors for giving gentle Vibrations or Shocks through any Part of the Body, three Pair of different-ſized Metal Balls, two Braſs and two Wood Conical Points, Chains, Clamp, and Box of Amalgam, in a coloured Deal Box	7	17	6
Ditto, ditto, as above, with the addition of a ſecond Medical Jar for the other Conductor, two ſetts of ſtiff Joints, and two compound Joints, (in lieu of the ſimple Joints), forked Keys, Screw-driver and Pointril, in a coloured Deal Box	10	10	0
Ditto, ditto, as above, with a Wood Clamp, Metallic Cord, an inſulated Stool, and luminous diſcharging Rod, in a coloured Deal Box -	12	12	0

Although the above Machines are more particularly conſtructed for Medical Purpoſes, they are equally applicable to Philoſophical Uſes, and will be found to produce a greater quantity of Electric Fire, than any Machine, of the ſame ſize, hitherto made; and have alſo ſufficient ſtrength for any medical purpoſe whatever; to which they may be applied. They have likewiſe this ſuperior advantage, in anſwering the purpoſe of a perſon being electrified at the ſame time with two Electrical Machines; for, while it receives the Electric Fluid from one part of the body, it will give it to any other part deſired.

Any perſon that may be deſirous to try the medical effects of Electricity, without purchaſing the Electrical Machine, is reſpectfully informed, he may have the Uſe of either of the before-mentioned ones, on depoſiting the value of the Machine before its delivery; and what remains of the ſum depoſited, after deducting Ten Shillings and Sixpence for any time leſs than a Week, and Eighteen-pence for every day after that it is in his poſſeſſion; the expence for any damage that it may have ſuſtained from the time of delivery to its return, and the carriage. After theſe various expences are deducted, what then remains of the ſum depoſited, ſhall be paid on the return of the Machine.

N.B. No Machine will be lent, without its value is depoſited before the delivery.

					£.	s.	d.
Electrical Machines for common Electrical Experiments -					4	4	0
Patent Electrical Machines, on a larger ſcale than thoſe before mentioned, from - -	16	16	0	to	168	0	0
Electrical Batteries, from -	2	12	6	to	92	8	0
Electrical Jars, from -	0	7	6	to	0	0	0
Diamonded Jar - -					0	10	6
Belted Jar, or Analyſis of the Leyden Vial - -					0	16	0
Double Jar - -					0	16	0
Magical Picture - -					0	12	6

Nairne's

		£.	s.	d.		£.	s.	a.
Nairne's Luminous Diſcharging Rod						0	7	6
Inſulated Jointed Diſcharging Rod						0	10	6
Univerſal Diſcharger						1	10	0
Jar and Electrometer						1	10	0
Quadrant Electrometer						0	7	6
Gold-Leaf Electrometer						0	14	0
Cavallo's Electrometer						0	14	0
A Thunder-Houſe						0	5	0
A Powder Magazine						0	15	0
A Pyramid						0	12	0
A Boat						0	18	0
A Set of Bells						0	9	0
A Set of Bells, mounted on a Stand						1	1	0
Plates and Images						0	6	0
Jar and Artificial Spider						0	12	0
A Set of Muſical Bells						1	11	6
Luminous Conductors, from		1	1	0	to	1	16	0
Exhauſted or Luminous Flaſk						0	10	6
Spiral Tubes, from		0	7	6	to	0	10	6
Set of Spirals, with Flyer						1	16	0
Luminous Words, from		0	16	0	to	1	11	6
Electrical Star						0	18	0
An Electrical Planetarium	to be ſet in motion by the electric fluid					3	3	0
Electrical Orrery						1	6	0
A Set of Paper Models						3	0	0
Flyer and Point						0	4	0
Electrical Piſtols, from	for inflammable air	0	7	6	to	1	16	0
Ditto, mounted in ſets						1	2	6
Electrical Tinder-Box						3	10	0
Ditto, ſmaller, with Electrophorus						2	12	6
Electrophorus, from		0	7	6	to	4	4	0
Electrical Canon for Gunpowder						0	15	0
Electrical Sportſman						2	12	6
Inſulated Stools, from		0	12	0	to	0	18	0
Conductors for Ships, to preſerve them from the dangerous Effects of Lightning		3	3	0	to	7	7	0
Ditto for Buildings								

	£.	s.	d.		£.	s.	d.
Alſo, all the different Electrical Apparatuses, either for Amuſement, or Philoſophical Uſes, hitherto known.							

Optical Inſtruments.

Beſt Double-joint Silver Spectacles, with Glaſſes - -					1	1	0
Ditto ditto Silver Spectacles, with Brazil Pebbles - -					1	16	0
Ditto Single-joint, Silver, with ditto - - -					1	10	0
Ditto ditto, ditto Spectacles with glaſſes - -					0	15	0
Ditto, Double-joint Steel ditto, with ditto - -					0	10	6
Another Sort ditto - -					0	7	6
Another Sort ditto, for Ladies					0	10	6
Beſt Single-joint Steel Temple Spectacles - -					0	5	0
Another Sort ditto - -					0	2	6
Other Sorts ditto, at per Dozen	0	12	0	to	1	4	0
Spectacle Caſes, from -	0	1	0	to	2	2	0
Noſe Spectacles, mounted in Silver					0	7	6
Noſe ditto, in Tortoiſeſhell, and ditto - - -					0	4	0
Ditto ditto, in Horn and Steel -					0	1	6
Other Sorts ditto, at per Dozen	0	3	6	to	0	14	0
Spectacles with green Glaſſes; alſo green Shades for Weak Eyes - - -							
Concave Glaſſes in Horn Boxes, for ſhort-ſighted People -					0	1	6
Ditto ditto, mounted in Tortoiſeſhell and Silver, Pearl and Silver, &c. at various Prices							
Reading Glaſſes, from -	0	2	6	to	1	16	0
Burning ditto, from - -	0	1	0	to	0	4	6
Small Pocket Magnifying Glaſſes for Watch-makers, &c. from	0	1	0	to	0	5	0

Concave

	£.	s.	d.		£.	s.	d.
Concave and Convex Mirrors, in Frames, from - -	0	7	6	to	50	0	0
Cylindrical ditto, in ditto, from	1	1	0	to	13	13	0
Opera Glaſſes, from - -	0	7	6	to	0	16	0
Ditto, in Silver, from -	1	11	6	to	4	4	0
Ditto, in Gold - -							
Refracting Teleſcopes, of various Lengths, from - -	0	7	6	to	1	11	6
Ditto, to uſe at Sea by night -	1	11	6	to	2	12	6
Ditto, ditto, with Achromatic Object Glaſſes, from -	1	1	0	to	76	0	0
An Achromatic Teleſcope, about 30 Inches long, with two Sets of Eye-Glaſſes; the one magnifying about 40 times, for Day, and the other about 75 times, for Aſtronomical Purpoſes, in a neat portable Mahogany Box - -					10	10	0
Alſo all the various ſorts of Achromatic Teleſcopes, particularly thoſe of one, two, three, and four feet long, with Braſs Drawers, which ſhut up commodiouſly for the Pocket, from - - -	2	12	6	to	13	13	0
Achromatic Perſpective Glaſſes for the Pocket, of various Prices, from - -	1	1	0	to	4	4	0
Reflecting Teleſcopes, ſix Feet long, with four magnifying Powers, and Rack Work, on Mahogany Stand - -	105	0	0	to	150	0	0
Ditto ditto, four Feet long, with four magnifying Powers -	78	15	0	to	100	0	0
Ditto ditto, three Feet long, with ditto - - -	40	0	0	to	56	0	0
Ditto ditto, two Feet long, on Braſs Stands, with ditto -	18	18	0	to	30	0	0
Ditto ditto, two Feet long, with							

one

	£.	s.	d.		£.	s.	d.
one magnifying Power, on a three-legged Braſs Stand -					12	12	0
Ditto ditto, 18 Inches long -					8	8	0
Ditto ditto, 12 Inches long -					5	5	0
Double-reflecting Microſcopes, from - - -	4	14	6	to	7	17	6
Solar Microſcopes, with complete Pocket Microſcope -					5	5	0
Opaque Microſcopes, from -	2	2	0	to	3	3	0
Ellis's, or Aquatic ditto, with adjuſting Screw - -					2	12	6
Pocket Microſcopes, from -	0	6	0	to	3	13	6
Camera Obſcuras, from -	0	16	0	to	7	17	6
Optical Machines for viewing perſpective Prints, from -	0	18	0	to	1	16	0
Scioptic Balls and Sockets -					0	7	6
Glaſs Priſms, from - -	0	7	6	to	2	2	0
Magic Lanthorns - -					1	8	0
Paintings for ditto, from Eight Shillings per dozen Squares, to					1	10	0
Metal Cylindrical Mirror, with Set of Prints - -					2	2	0

Mathematical Inſtruments.

	£.	s.	d.		£.	s.	d.
Globes, 28 Inches Diameter, in Mahogany Frames, with ſilvered Meridians, &c. complete					52	10	0
Ditto, ditto, in Wainſcot Frames					40	0	0
Ditto, 17 Inches, in ditto -					6	6	0
Ditto, 15 ditto, in ditto -					5	5	0
Ditto, 12 ditto, in ditto -					3	6	0
Ditto, 9 ditto, in ditto -					2	2	0
Ditto, 6 ditto, in ditto -					1	16	0
Ditto, 3 ditto, in Fiſh Caſes, for the Pocket - -					0	10	0
Hadley's Quadrants, from -	1	16	0	to	6	6	0
Hadley's Sextants, with adjuſting Screw and Teleſcope, for de-							

termining

	£.	s.	d.		£.	s.	d.
termining the Longitude at Sea, from	6	16	6	to	15	15	0
Parallel Glaſs, with adjuſting Screw and Level, for an artificial Horizon							
Theodolites, from	4	4	0	to	11	11	0
Ditto, better Sort, with Ground Levels, from	18	18	0	to	31	10	0
Circumferentors, from	2	2	0	to	4	14	6
Plain Tables, with Staff, Ball, and Socket	4	14	6	to	5	15	6
Perambulator, or Meaſuring Wheel	6	6	0	to	10	10	0
Level Teleſcopes and Apparatus, at different Prices							
Pentagraphs for copying Drawings, from	2	12	6	to	5	5	0
Caſes of Drawing Inſtruments, from	0	7	6	to	30	0	0
Ditto ditto, the Inſtruments of Silver							
Proportionable Compaſſes							
Beam Compaſſes and Elliptical Compaſſes							
Azimuth, Cabin, and all other Sea Compaſſes, of various Prices							
Horizontal Sun-Dials, from	0	15	0	to	8	8	0
Univerſal Ring-Dials, from	0	7	6	to	4	4	0
Ditto ditto, with Compaſs-Box, Needle, Levels, adjuſting Screws, &c.					21	0	0
Meridian Teleſcopes, or Tranſit Inſtruments							
Aſtronomical Quadrants							
Equatorial Teleſcopes							
Dipping Needles of a new Conſtruction							
Levels whoſe inner Surfaces are ground, from	1	11	6	to	30	0	0
Ditto, common, from	0	12	0	to	1	11	6

	£.	s.	d.		£.	s.	d.
Gunter's Chains							
Ditto Quadrants, from	0	3	6	to	0	5	0
Sutton's ditto, from	0	5	0	to	0	10	6
Davis's ditto, from	0	10	6	to	0	16	0
Gunner's Callipers							
Protractors, from	0	1	6	to	2	12	6
Parallel Rules of all Sorts, from	0	3	6	to	2	2	0
Gauging Rods, Gunter's Scales, and all other Kind of Rules							
The Regular Solids, or Platonic Bodies, cut in Wood							

Philoſophical Inſtruments.

Pocket Travelling Compaſſes, of a peculiar Conſtruction, from	0	7	6	to	3	13	6
Air Pumps, of different Kinds, from	3	3	0	to	40	0	0
Apparatus to ditto							
Air Pumps of Mr. Smeaton's Conſtruction							
Barometers					1	16	0
Ditto					2	12	6
Ditto, with Thermometers					3	13	6
Ditto, with ditto, and Hygrometer					4	4	0
Marine Barometers, which have been found, by Experience, to foretell Storms at Sea, Hours before they come on					10	10	0
Thermometers in Mahogany Boxes, Farenheit's Scale					1	11	6
Ditto ditto, with Farenheit's and Reaumur's ditto							
Ditto, on Box Scales					1	1	0
Pocket Thermometers in Fiſh Caſes					1	1	0
Ditto ditto, with Farenheit's and Reaumur's Scales							

Botanic

	£.	s.	d.		£.	s.	d.
Botanic Thermometers -					0	18	0
Brewer's, &c. ditto, in Tin Caſes					0	12	0
Ditto, with Metal Scales and Boxes - - -							
N. B. The Scales of theſe Thermometers are graduated according to the Bores of their reſpective Tubes							
Glaſs Bubbles in Mahogany Boxes, with Thermometers, as uſed in the Weſt-Indies, to prove Rum, Brandy, &c -					1	10	0
Hygrometers in Braſs Boxes -					0	12	0
Ditto, of Mr. Smeaton's Conſtruction - - -					2	12	6
Air Fountains, in Copper, with complete Set of Jets -	3	13	6	to	6	6	0
Ditto ditto, to play fired Spirits							
The Mechanic Powers, neatly made in Braſs, conſiſting of the Wheel and Axle, the Pulley, Weights, the Wedges, inclined Plane and Roller, and the different Kinds of Levers -					25	4	0
Hydroſtatic Balances, with complete Apparatus - -	3	13	6	to	16	16	0
Artificial Magnets, from -	0	1	6	to	10	10	0

All other Optical, Mathematical, and Philoſophical Inſtruments, made according to their lateſt Improvements, at the loweſt Prices.

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